

Claims

I claim:

- 1 1. A method for partitioning an image including a plurality of points into segments,
2 comprising:
3 selecting a set of base points in the image;
4 initializing and emitting a wavefront from each base point;
5 propagating each wavefront according to a speed function until a termination
6 condition is satisfied to determine a corresponding final wavefront; and
7 segmenting the image according to each final wavefront.
- 1 2. The method of claim 1, further comprising:
2 constructing a gradient image from the input image;
3 constructing a variance image from the input image; and
4 selecting each base point iteratively in order of least gradient and variance
5 values in the respective gradient and variance images.
- 1 3. The method of claim 2, in which a likelihood of selecting the base point is
2 inversely proportional to the gradient and variance values.
- 1 4. The method of claim 2, in which the gradient image and the variance image are
2 constructed at hierarchical resolution levels.
- 1 5. The method of claim 1, in which the initial wavefront is substantially circular.

1 6. The method of claim 1, in which the speed function varies according to colors in
2 the image.

1 7. The method of claim 6, in which a speed of propagation increases for adjacent
2 points having a similar color and decreases for the adjacent points having a
3 dissimilar color.

1 8. The method of claim 6, in which a speed of propagation increases for adjacent
2 points having a low average gradient magnitude and decreases for the adjacent
3 points having a high average gradient magnitude.

1 9. The method of claim 6, in which a speed of propagation increases for adjacent
2 points having a low gradient magnitude on the normal direction to the wavefront
3 and decreases for the adjacent points having a high gradient magnitude on the
4 direction normal to the wavefront.

1 10. The method of claim 1, in which the termination condition is a color similarity
2 of the points.

1 11. The method of claim 1, in which the termination condition is an edge in the
2 image.

1 12. The method of claim 1, in which the termination condition is an arrival time of
2 each wavefront.

1 13. The method of claim 1, in which the speed function is constant.

1 14. The method of claim 1, in which the speed function is varying.

1 15. The method of claim 1, in which the propagating is performed iteratively using
2 fast marching.

1 16. The method of claim 15, further comprising:

2 choosing \mathbf{x}^* as a point in a narrow band set of points with a smallest arrival
3 time $\psi(\mathbf{x}^*)$ of the wavefront;

4 moving point \mathbf{x}^* from the narrow band set of points to a current segment;

5 moving all neighboring points \mathbf{x}_j^* of the point \mathbf{x}^* into the narrow band set of
6 points if the neighboring points are not in the narrow band set of points;

7 updating the arrival time $\psi(\mathbf{x}_j^*)$ for all the neighboring points of \mathbf{x}^* ,

8 updating a color mean for the current segment;

9 updating a color mean for the narrow band set of points;

10 increasing a total number of points in the current segment; and

11 updating a total number of points in the narrow band set of points.

1 17. The method of claim 16, in which the color mean of the current segment is S_K ,

2 and updated the color mean by $S_K^t = 1/N_K^t [N_K^{t-1} S_K + I(\mathbf{x}^*)]$, where t is time, and

3 N_K is the total number of points in the current segment, and I is the image.

1 18. The method of claim 16, in which the narrow band set of points is the

2 wavefront.

1 19. The method of claim 16, in which the color mean of the narrow band set of
 2 points is B'_K , and the color mean is updated by $B'_K = 1/M_{iK} [M^{t-1}_{iK} B_K - I(\mathbf{x}^*_j) +$
 3 $\sum_j^c I(\mathbf{x}_j)]$, where M_K is the number of points in the current narrow band set.

1 20. The method of claim 16, in which the color mean S_K of the current segment and
 2 the color mean of the narrow band set of points are used to determine color
 3 similarity.

1 21. The method of claim 16, in which a set of representative colors for the current
 2 segment and a set of representative colors for narrow band set of points are used to
 3 determine color similarity.